

Nursery raising with High Density Sugarcane Transplanting

for higher cane yield and profitability

Ravindra Singh¹, Wazeer Singh² and Sharda Choudhary³

Sugarcane Breeding Institute, Regional Centre, Karnal, Haryana 132 001

INDIA is one of the largest sugarcane producers in the world after Brazil. Sugarcane being an important cash crop, it ranks third in the list of most cultivated crops after paddy and wheat. Sugarcane is planted in both tropical and sub tropical region of India over 4.94 million hectare area with total production of 339.2 million tons and productivity of 68.6 tonnes per hectare. In the Sub Tropical Zone, the major sugarcane growing states are Uttar Pradesh, Haryana and Punjab having 2.184, 0.106 and 0.085 million hectare area with very low productivity of 56.7, 67.0 and 60.0 tonne per hectare, respectively.

Why Nursery Raising and High Density Sugarcane Transplanting?

Sugarcane - ratoon - wheat is the most prevalent sugarcane based

cropping system in Sub Tropical Zone. The temperature during summers remain very high and during winters very low, restricting the sugarcane growth in both ends of the growing season in Sub Tropical Zone. A drastic reduction in the yield of late planted sugarcane, after wheat harvest is observed under this system. In spite of low yield of plant cane, farmers are forced to delay the planting of cane till wheat harvest as wheat meets the need of both food and fodder for their families and the animals they keep. During summers, higher temperature at germination and lower moisture availability leads to mortality of the plants and create gaps and uneven plant stand. Whereas in transplanted sugarcane, the single budded setts are raised in the nursery during

February and 40-45 days old settlings are transplanted in the field after wheat harvest which stay away from the germination stage.

What is High Density Sugarcane Transplanting?

High density sugarcane transplanting (HDST) where in 55,556/ha sugarcane settlings is planted at 60×30 cm spacing after wheat harvest. The sugarcane settlings is raised in nursery by transplanting of single bud pre-germinated shoots in soil which helps in improvement in cane yield of late planted crops after wheat harvest. This technique leads to a significant reduction in the cost of seed cane which compensate for the additional cost in nursery raising and transplanting. In conventional method, nearly 8.0-10.0 t/ha cane

The utilization pattern of sugarcane in India show that 70.70 and 17.4 % cane produced is utilized for production of white sugar and gur and khandsari, whereas 11.90 % (40.36 million tonnes) of the cane produce is used as seed and feed. If we compare the sugarcane productivity in tropical and sub tropical states, the productivity levels are 102.5 tonnes/ha in Tamil Nadu whereas it is 56.7 tonnes/ha in Uttar Pradesh showing huge gap in productivity. The major reasons for lower productivity levels in Sub Tropical Zone can be attributed to short growth period of summer planted sugarcane after wheat harvest coupled with extreme climatic conditions during summers as well as in winters under which sugarcane is cultivated. Other factors like poor tillering, poor weed management and negligence of plant protection measures lead to poor cane quality and hence productivity. Most of the sugarcane growing farmers in India planting sugarcane using 3 budded sets by end to end method, in which 8.0-10.0 t/ha sugarcane is required as seed material, whereas 2.0 tones/ha seed is sufficient by transplanting of seedlings/saplings raised in the nursery. This shows that 6.0 tonnes/ha sugarcane can be saved from the seed material which can provide 29.64 million tonnes additional cane to the sugarcane industries for crushing to prepare white sugar.

seed is utilized as planting material, whereas 1.6-2.0 t/ha seed cane is sufficient to transplant one hectare in HDST. Improved crop geometry through proper spacing of the plants by maintaining higher plant density is thus crucial for enhancing productivity in the plant crop of sugarcane. As the crop is transplanted after wheat harvest, higher plant density gives more mother shoots than the secondary or tertiary sprouted shoots/ tillers and ultimately higher number of millable canes per unit area. This technique is also useful to improve cane yield, sugar recovery and advance cane planting as 5 to 6 weeks old settlings are being transplanted in the field. Raising cane crop by HDST method increases stalk population by 20-25 per cent over conventional method of planting.

Raising of Plants in Nursery

Plant saplings/settlings can be prepared using single budded sett and raising in the nursery 40-45 days before transplanting. The plants settlings can be raised in nursery having small area about 50 m² (5m × 10m). The area should be well prepared to a depth of about 15 cm and small plots of about 1m² areas have to be made. Chloropyriphos 20% E C has to be applied to the soil. In each small plots nearly 700-800 single budded sets can be accommodated depending on the thickness of the sets. Sets should be dipped in Dithane M-45 (250 gm in 100 liter water solution) for 10 minutes. About 20 quintal seed is sufficient to raise the nursery for 1 hectare sugarcane planting. Single buds have to be drawn from upper half



Settlings in nursery

of the cane stalk by cutting just above the growth ring and having 5-6 cm of the internodes below the bud. The nursery has to be irrigated adequately and the single budded sets have to be dibbled horizontally keeping the buds and root buds just below the soil surface. Frequent irrigations are required in the nursery to maintain optimum moisture level. Eighty-five to Ninety-five percent of the buds will sprout within 2-3 weeks time. After six weeks the plants are ready for transplanting in the field. At this stage 3-4 green leaves appear in most of the settling which are more suitable for survival and better tillering.

Time of Raising Nursery

The most suitable time for raising the nursery is between mid February to mid March. In Sub Tropical sugarcane growing region, during this period, the temperature is optimum for germination of buds. Moreover the availability of seed from the top stalk is also more due to peak season for crushing of sugarcane in the mills.

Preparation of Settlings

Settlings are carefully removed from the nursery and de-topped with a sharp knife before



Plantlets ready for transplanting

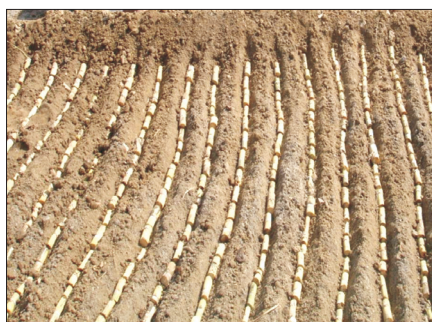
transplanting. The de-topped settlings are dropped in Aretan solution @ 0.1% and taken out immediately.

Field Preparation

The field is prepared before transplanting the plants by one deep ploughing followed by three harrowing and planking. The furrows are opened at 60 cm row spacing by ridger.

Transplanting of Settling

The cane rows have to be opened and settlings are transplanted in furrow at a distance of 60 cm between rows to row. The plant to plant distance has to be kept 30, 45 and 60 cm as per treatment to create different plant density. The settlings are dibbled and covered with soil, leaving about 5 cm portion of the shoot above the ground. Before transplanting the settlings, the field should be irrigated lightly (2/3 portion of the furrow) with irrigation water. After ten days of transplantation, the gaps, if any, due to mortality of transplants have to be filled by the settlings from the nursery kept in reserve and irrigated immediately. With normal management practices 3-5 percent mortality has been observed.



Single bud setts planted in Nursery



Plantlets uprooted from nursery



Transplanting of plantlets in field



Irrigation after transplanting

The experiment was carried out at Karnal during 2009-10 for standardization of plant density for transplanted sugarcane by raising the nursery using single budded sets. After standardization of the plant density, number of field demonstrations were also carried out at farmers field to disseminate the technology. The results show that cane yield was significantly maximum (103.17 tonnes/ha) at 60×30 cm spacing treatment wherein 55,556 plants/ha were transplanted, which were higher by 17.3 and 62.6% as compared with 60×45 cm (37,037 plants/ha) spacing and 60×60 cm (27,778 plants/ha) spacing, respectively (Table 1). The results of field demonstration conducted at farmers field also show that the cost of cultivation of transplanted sugarcane is lower by ₹ 16,846/ha then the planting with 3 budded sets due to less seed requirement and other resources (Table 2). The

Table 1. Effect of high sugarcane plant density on cane yield, pol %, commercial cane sugar (CCS%) and CCS yield of transplanted sugarcane at harvest

Particulars	Spacing cm (Row × Plant)		
	60 × 30	60 × 45	60 × 60
No. of Sugarcane settlings transplanted/ha	55556	37037	27778
Single cane weight (g)	809.8	824.1	858.7
Cane length (cm)	186.9	180.3	181.3
Cane girth (cm)	2.55	2.53	2.52
NMC ('000/ha)	125.1	104.7	72.3
Cane yield (tonnes/ha)	103.17	87.95	63.45
Pol (%)	16.46	16.31	16.5
Commercial cane sugar (CCS) (%)	11.18	11.04	11.22
CCS Yield (tonne/ha)	11.63	9.85	7.22

improvement in cane yield of the plant crop due to HDST were 10.7 and 16.8 tonnes/ha over sett planted cane during 2010-11 and 2011-12 respectively (Table 2). The ratoon yield was also improved by 14.9 and 15.7 tonnes/ha during both the years of the demonstrations. HDST method of transplanting of the sugarcane gave higher net returns to the tune of ₹ 75,132 during 2011-12 and ₹ 99,870 during 2012-13 as compared with sett planting.

Increase in plant density in plant crop through reducing plant to plant spacing, significantly enhance number of millable canes and cane yield in plant crop as well as ratoon crop due to uniform plant stand and higher millable canes. In this system sugarcane settlings are grown in nursery before wheat harvest and transplanted in the field immediately after wheat harvest,



Uniform plant stand in plant crop of transplanted sugarcane

which reduces the losses due to late planting of sugarcane. This method advances the crop growth stage 40-45 days as plantlets are used for transplanting in the field.

Advantages of adopting HDST

- Saving in the seed cost as the seed requirement is only about 1.6-2.0 t/ha against the normal seed requirement of 8-10 tonnes/ha.
- Synchronous tillering, uniform growth leading to higher number of matured stalk

Table 2. Comparative yield and net returns of high density sugarcane transplanted (HDST) and 3 budded sett planted cane at farmers field in Karnal Sugar Mill

Particulars	High density sugarcane transplanting (HDST)		Direct planting of 3 budded sets	
	2010-11	2011-12	2010-11	2011-12
No of demonstrations conducted	43	14	10	5
Area demonstrated (ha)	67.2	12.4	10.2	3.00
Cane yield of plant crop (tonnes/ha)	77.6	87.3	66.9	70.5
Cost of cultivation (₹/ha) plant crop	65300	65300	82146	82146
Sugarcane price (₹/quintal)	210	240	210	240
Gross returns (₹/ha) plant crop	163018	209568	140558	169200
Net returns (₹/ha) plant crop	97718	144268	58412	87054
Cane yield ratoon crop (tonnes/ha)	87.6	89.6	72.7	73.9
Sugarcane price (₹/quintal)*	240	271	240	271
Net returns (Ratoon)	167241	199728	131415	157072
Total net returns ₹/ha (Plant + ratoon sugarcane)	264959	343996	189827	244126
Profit over set planting	75132	99870	-	

* Plant crop of 2010-11 and 2011-12 ratooned during 2011-12 and 2012-13, respectively



Uniform plant stand in ratoon of transplanted sugarcane after harvesting the plant crop

population which usually gives better sugar recovery.

- Sufficient time availability to prepare the main field after wheat harvest.
- Saving of 2-3 irrigations in plant crop as single budded sets are used for nursery raising and transplanted in the field after 40-45 days stage.
- Possibility of increased cane yield in plant as well as ratoon crop due to higher plant stand and number of millable canes (NMC).
- Very less or no gaps in ratoon as healthy settlings/ saplings are transplanted for raising plant crop.
- Better weed management as transplanted settlings establish faster and crop enters directly in grand growth stage as it avoids germination phase in the field.
- Efficient fertilizer management.
- Better care of the plants as nursery raised in limited area

Limitations of HDST

- Mortality of saplings if transplanted in bright sunny day
- The farmer should require the knowledge of knowhow of the technique before adaptation
- More care is required in nursery raising of the sugarcane

Points to be Remembered before Transplanting of Saplings Under HDST

- Transplanting should be done in the evening hours and require immediate irrigation. Saplings should be uprooted carefully by minimum damage to the roots of the plants
- Irrigate the nursery before uprooting for transplanting
- Discard the damaged / unhealthy saplings in the nursery
- If possible transplanting have to be done in 4-5 cm standing water during cloudy day, which reduces the mortality of the saplings
- Cut 1/3 top leaves after

uprooting the settlings from the nursery and before transplanting in the field to reduce the moisture loss from the saplings/ plantlets

SUMMARY

In sugarcane, high density sugarcane transplanting (HDST) is done using 55,556 plantlets or settlings/ha by transplanting of the settlings raised in the nursery at narrow spacing (60 x 30 cm). Adaptation of HDST not only reduce the cost of sugarcane production but also improve number of millable canes, cane yield in plant as well as ratoon crop with higher net returns and profitability in Sub Tropical Zone of India.

¹ Senior Scientist, NRC on Seed Spices, Tabiji, Ajmer; ² Cane Manager, The Karnal Cooperative Sugar Mills, Karnal, Haryana 132 001; ³ Scientist, NRC on Seed Spices, Tabiji, Ajmer 305 206
